Q-3 National data in the 1960s showed that about 44% of adult population had never smoked.

(a) State null & alternative hypothesis to test that the fraction of 1995 population of adults that had never smoked had increase

⇒ Null hypothesis - The fraction of population in 1995 of adults that had never smoked is equal to 44%.

$$H_0 = P = 0.44$$

Alternate hypothesis - The fraction of population in 1995 of adults that had never smoked is greater than 44%. ie 0.44.

$$H_A = P > 0.44$$

(b) A National random sample of 891 adults were interviewed & 463 stated that they had never smoked. perform a z test hypothesis & give app. P value

Notes

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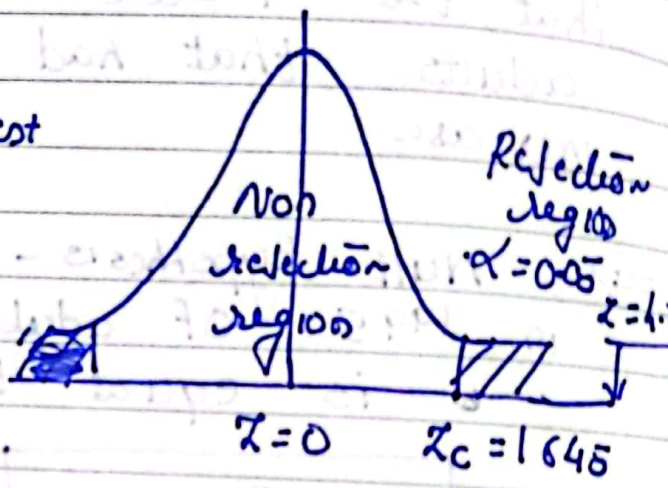
$\Rightarrow$

Total no of samples $n = 891$

$x = 463$

Type I error rate is 0.05 [we will assume 5% significant level

$\alpha = 5\% = 0.05$



This is one tailed test

The table value is the sample results must yield z value greater than 1.645, for the population of adults who do not smoke to reject the null hypothesis

$n = 891$ & $x = 463$

$\hat{p} = \frac{463}{891} = 0.519$

Z-test $z = \frac{\hat{p} - p}{\sqrt{\frac{p \cdot q}{n}}}$

Notes

$$Z = \frac{0.519 - 0.44}{\sqrt{\frac{(0.44)(0.56)}{891}}}$$

$$Z = \frac{0.079}{\sqrt{0.000276}} = \frac{0.079}{0.0166} = 4.75$$

$$\boxed{Z = 4.75}$$

$Z_0 = \pm 1.645$: so reject the null hypothesis

So Fraction of population in 1995 of adult that have never smoked is more than 44%.

$\alpha = 5\% = 0.05$

$$Z_\alpha = \frac{\hat{P}_c - P}{\sqrt{\frac{P \cdot q}{n}}} \quad \therefore \quad 1.645 = \frac{\hat{P}_c - 0.44}{\sqrt{\frac{(0.44)(0.56)}{891}}}$$

$$1.645 = \frac{\hat{P}_c - 0.44}{0.0166} \quad \therefore \hat{P}_c = 0.44 + (1.645)(0.0166)$$

$$= 0.44 + 0.027$$

$$\boxed{\hat{P}_c = 0.467}$$

With the critical value method a sample proportion is greater than 0.467 to reject the null hypothesis.

So the null hypothesis is also rejected by critical value method

(c) Create a 98% confidence level for the proportion of adults who had been smoke

$\Rightarrow$ 98% confidence level

The size of the sample is no more than 2% of the size of the population

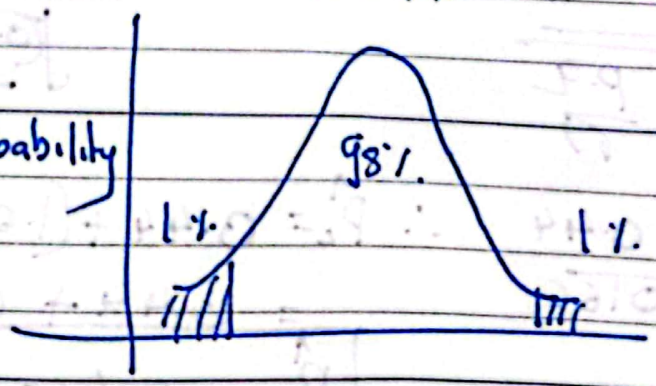
$$np(1-p) \geq 10$$

$$(891)(0.519)(1-0.519) \geq 10$$

$$(891)(0.519)(0.481) \geq 10$$

$$222.42 \geq 10$$

$$\hat{p} + z\sqrt{\frac{\hat{p}(1-p)}{n}}$$



$\alpha = 0.02$

Notes

$Z_{0.020}$

from z table

$Z_{0.02} = 1.96$

$$\hat{p} \pm Z_{\alpha} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$$= 0.519 - 1.96 \sqrt{\frac{0.519(1-0.519)}{891}}$$

$$= 0.519 - 1.96 \sqrt{0.00028}$$

$$= 0.519 - 1.96 (0.016)$$

$$= 0.519 - 0.03136$$

$$= 0.48764$$

Notes

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Wednesday

(d) Give the value of power function $\pi(p)$ for $p = 046, 0.48, 0.50, 0.52$ with $\alpha = 0.02$ & greater than. alternative hypothesis

$\Rightarrow$ $\alpha = 0.02$

Null hypothesis $H_0 = 0.46$ &

alternate hypothesis $H_A > 044$

Notes